

REMARKS

The application has been amended and is believed to be in condition for allowance.

There are no formal matters pending.

Amendments to the Disclosure

Independent claims 12 and 13 are amended to incorporate the subject matter of dependent claim 20, as supported by the specification and the drawing figures originally filed (e.g., paragraphs [0033]-[0034] of the specification). Dependent claim 21 is amended to depend from claim 12. Claims 20 and 22 are canceled, without prejudice.

The claims are further amended in a non-substantive manner to address minor formal issues in consideration of U.S. practice and preferences.

It is respectfully submitted that the foregoing amendments do not introduce new matter. Accordingly, it is respectfully submitted that the claim amendments are proper.

Entry of the amendments to the claims is respectfully solicited.

Provisional Double Patenting

The Official Action provisionally rejected claims 12, 18, 20 and 21 on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 1-5 and 10 of co-pending Application No. 11/659,201 (US Pub. 2009/0022648) in

view of Ahn et al. (US 6,454,912; "AHN"), and Nakanishi et al (US 4,894,510; "NAKANISHI").

In response, the provisional rejection is noted. However, since this rejection has been indicated as provisional, Applicants respectfully maintain that no Terminal Disclaimer is required at this time.

Should co-pending U.S. Application 11/659,201 go to allowance, for example, the matter of the provisional rejection with respect to the present application should be re-visited and a determination made at that time in consideration of any amendments made to the claims of the present and the co-pending applications.

Substantive Issues - Section 103

The Official Action rejected claims 12, 14, 16, 18, and 22 under 35 USC 103(a) as being unpatentable over Gruen et al. (US 5,772,760; "GRUEN") in view of Matsuoka et al. (US 5,022,977; "MATSUOKA"), AHN, and NAKANISHI.

The Official Action rejected claims 13, 15, 17, and 19 under 35 USC 103(a) as being unpatentable over GRUEN in view of MATSUOKA, AHN, NAKANISHI, and Dearnaley (US 5,393,572; "DEARNALEY").

The Official Action rejected claims 20 and 21 under 35 USC 103(a) as being unpatentable over GRUEN, MATSUOKA, AHN, NAKANISHI, DEARNALEY, and Sano et al. (US 6,372,304; "SANO").

The rejections are respectfully traversed for at least the reasons that follow.

As to the primary reference, the Official Action contends that GRUEN teaches a plasma generating means and a means for introducing precursors comprising a sublimation oven with a gas introduction pipe, referencing Figures 1A, 1B, and column 2, line 50 to column 4, line 5.

However, it is respectfully submitted that none of GRUEN or any of the other cited references, individually or in combination, teaches or suggests a means for generating high electron temperature plasma configured to maintain an electron energy at 15 to 50 eV, as recited in independent claims 12 and 13.

The Official Action relies on MATSUOKA as teaching a plasma generating apparatus configured to generate the energies recited in the claims. However, MATSUOKA fails to specify energies in terms of electrons. On the contrary, MATSUOKA discloses energy at four passages: "5 eV and 25 eV" at line 27 of column 12; "between several electron volts and dozens of kilo electron volts" at line 64 of column 12; "from 20 eV to 100 eV" at line 55 of column 13; and "the particles can be controlled over a wide range, from a few electron volts thousands of electron volts" at line 19 of column 23.

In each of the foregoing passages, energy is clearly disclosed in terms of ion energy. Electron energy, as recited in

the claims, is not disclosed. Even in the last passage, "particles" are directed to ions not electrons.

MATSUOKA is directed to ion energy because MATSUOKA is essentially a spattering apparatus, wherein the control of ion energy is important. In MATSUOKA, ions are accelerated (i.e., receive energy) in order to collide upon a target, whereupon atoms scattered from the target are accumulated on the deposition substrate (see column 10, line 36 to column 11, line 37).

In stark contrast, the present recites means for generating high electron temperature plasma at a specified electron energy efficiently generate monovalent ions. The device disclosed by MATSUOKA, by itself or modified by the secondary references, fails to teach or suggest this feature.

As to the rejection in view of SANO, it is firstly noted that the independent claims 12 and 13 are amended, as indicated above. It is respectfully submitted that none of the cited references, individually or in combination, teaches or suggests an electron energy control means, arranged downstream side of the means for generating high electron temperature plasma, for controlling the electron temperature at 1 to 10 eV.

The Official Action concedes that the primary reference, GRUEN, fails to teach this feature.

The Official Action offers SANO as teaching a control electrode 14 located downstream of a plasma generating chamber, which is connected to a variable DC power supply (-50 V to +50 V)

that enables control of an energy of electrons reaching the plasma processing chamber 4, referencing Figure 1 and column 4, line 37 to column 5, line 23.

The Official Action contends that it would have been obvious to one of skill in the art to have provided the GRUEN apparatus with an electron energy controlling means downstream of the plasma generating means as taught by SANO "to enable control electron energy reaching the plasma processing chamber". The Official Action further contends that the electron energy range recited by the claim is within the energy range described by SANO.

Applicants respectfully disagree. SANO fails to teach an electron energy control means to produce a low electron temperature plasma comprised of M^+ and electrons with an electron energy in a range of 1 to 10 eV, as recited in amended claims 12 and 13. On the contrary, SANO teaches an electron/ion trap disclosed to "trap electrons contained in plasma and then make the electrons escape to the ground and thus permit only radicals (neutrons) contained in the plasma to pass therethrough," (column 4, lines 42-47).

SANO discloses "DC voltages ranging from -50 V to +50 V are applied to the mesh 14, [so that] the speed of film formation is increased. Especially, at 0 V, namely, in the case that the mesh 14 is grounded but no voltage is applied thereto, the highest electron trapping effects can be obtained," (column 5,

lines 9-13). “[A] stainless-steel mesh 14 serves to trap electrons contained in plasma and then make the electrons conduct to the ground and thus permit only radicals (neutrons) contained in the plasma to pass therethrough,” (column 5, lines 21-24).

In stark contrast, claim 12 and 13 recite an electron energy control means producing a low electron temperature plasma from a high electron temperature plasma. Hence, the recited energy control means slows electrons in a plasma flow, while the mesh disclosed by SANO removes them altogether.

Accordingly, it is respectfully submitted that the cited references, individually or in combination, fail to teach all the recitations of the independent claims 12 and 13.

It is further respectfully submitted that one of skill would not have modified the apparatus of GRUEN to incorporate a mesh for removing electrons from a plasma flow. GRUEN is directed to carbonaceous vapor and deposition of a diamond film using a plasma of a noble gas, or a noble gas/hydrogen mixture and a hydrocarbon gas or fullerene compound (see Abstract; column 2, lines 21-25). The plasma deposition apparatus is based upon known technology to generate a microwave field 25 via a microwave generator 23 (column 5, lines 34-38 and 62-64).

The Official Action suggests that “downstream of the plasma generating means” in order to “enable control electron energy reaching the plasma processing chamber”. However, it is clear from column 5, lines 39-64 and Figures 1-2 that GRUEN

teaches the "plasma generating means" and the "plasma processing chamber" as being the same element. The plasma 26 is excited by and inside the microwave field 25. That is, there is no "downstream" in which to place a mesh electron trap as disclosed by SANO.

Moreover, there is no teaching or suggestion in any of the applied references suggesting that the inclusion of SANO's electron trap would have any likelihood of success in the apparatus taught by GRUEN. On the contrary, it appears likely that introducing a wire mesh into GRUEN's plasma, charged, grounded, or neutral, would radically upset the deposition process which is supposed to take place on the periphery of the chamber (e.g., element 24; see column 5, lines 56-62). Not only is there any teaching suggesting a reasonable expectation of success, one of skill would have readily understood that the inclusion of SANO's mesh in GRUEN's plasma would have rendered GRUEN unsatisfactory for its intended purpose.

As is well known, the conclusion of obviousness is not sufficient merely because the references relied upon allegedly teach that substantially all aspects of the claimed invention were individually known in the art; an objective reason to combine the teachings of the references must be articulated with some rational underpinning to support the legal conclusion of obviousness. MPEP § 2143.01, paragraph IV. If proposed modification would render the prior art invention being modified

unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

It is respectfully submitted that, based at least on the reasons set forth above, the charged or grounded wire mesh of SANO would not only render GRUEN unsatisfactory for its intended purpose, it would also change the principle of operation behind GRUEN. Again, GRUEN describes a plasma deposition chamber, wherein a plasma is generated by microwave excitation. SANO, by contrast, discloses a plasma flow through the wire mesh, the wire mesh preferably connected to ground to remove electrons from the flow. GRUEN is not disclosed to operate with a plasma flow, and there is no teaching or suggestion that it would function in any configuration wherein a wire mesh would control electron energy to improve GRUEN's operation.

It is therefore respectfully submitted that, in addition to the deficiencies of SANO set forth above, one of skill would have had no reasonable motivation to combine the teachings of SANO with GRUEN. Accordingly, it is respectfully submitted that the invention as recited by the independent claims

12 and 13 are patentable over the references applied by the Official Action.

It is further respectfully submitted that claims depending from claims 12 and 13 are patentable at least for depending from a patentable parent claim.

Reconsideration and allowance of the claims are respectfully requested.

From the foregoing, it will be apparent that Applicants have fully responded to the November 30, 2009 Official Action and that the claims as presented are patentable. In view of this, Applicants respectfully request reconsideration of the claims, as presented, and their early passage to issue.

In order to expedite the prosecution of this case, the Examiner is invited to telephone the attorney for Applicants at the number set forth below if the Examiner is of the opinion that further discussion of this case would be helpful.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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